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N° 24,047 A.D. 1909

Date of Application, 20th Oct., 1909
Complete Specification Left, 20th Apr., 1910—Accepted, 25th Aug., 1910

PROVISIONAL SPECIFICATION.

Improvements in and connected with Pressure Pumping Machinery.

We, FREDERICK WILLIAM POATE, of 15, Sansouci Terrace, Shanghai, China, Engineer, and FAWCETT PRESTON AND COMPANY, LIMITED, of 17, York Street, Liverpool, in the County of Lancaster, England, Engineers, do hereby declare the nature of this invention to be as follows:—

This invention has reference to pumping machinery, and more particularly to that kind of such machinery which is used for pumping water to hydraulic presses of various kinds, such as cotton, hemp, and similar loose goods presses; bale goods presses; and analogous or equivalent presses. And it has for its chief objects and effects to generally improve such pumps, so that their parts shall be very accessible, leakages shall be visible, waste of power, and wear and straining of parts diminished, and their efficiency generally raised. While also at the same time it has been the object to provide a pumping machinery which is simple, and not costly.

In the following description of pumping machinery, the improvements hereunder are comprised.

It will be assumed in the following description that the pumps will be used for supplying water to presses where different quantities of water are to be pumped and supplied to the press at different periods or stages of its operation, or cycle of operation, and that in these periods or stages, the pressure of the water supplied varies; also that the pumps are driven by a belt, driven by a gas or oil engine.

The pump cylinders and plungers are in multiple, and are arranged in groups on each side of a driving or operating shaft. For instance, there may be advantageously employed 12 cylinders and plungers on each side, and the plungers will be worked by eccentrics, two eccentric straps mounted on a common eccentric pulley being connected to, and working two plungers, one at each side; and these plungers are arranged in groups, preferably of four, and the four plungers of each group are set at 90° to each other. By this arrangement shock in the pipe line is, to a great extent eliminated, as no two pump valves come to their seats simultaneously; and with the even discharge of water thus provided, there are no dead centres, and in consequence, a light fly wheel pulley on the pump driving shaft is sufficient to ensure even cyclic speed. And this is advantageous, especially in pumps driven by gas or oil engines through belts, as, in addition to a heavy fly wheel being costly, hunting sets up between the gas engine and the pumps, causing the belt to flap violently at each operative stroke of the engine.

Further, with regard to the grouping of the eccentrics and pumps, the "leader" eccentric pulley of the group will be 90° from the "following" eccentric in each group, as described, and all the "leader" eccentrics are equally spaced around the circle; and if there be twelve pumps arranged in three groups, these three "leader" eccentrics will be spaced apart at 120°.

The eccentrics will dip into a sump or pit provided in the bed of the pump,

[*Price* 8*d*.]

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holding oil, and a cover is provided over them to prevent the splashing of oil made by the eccentrics dipping in it.

The cross-heads preferably work in cylindrical slides, and the removable hood or cover over the pit or sump in which the eccentrics work may be carried from a rib or other provision formed on or attached to and extending between these cylindrical guides.

The pump cylinders are mounted on a bed, and outside this bed and below the level of the pumps, there is provided an open tank, say simply of thin steel or other suitable material, and into which the depending suction or intake pipes—which are short—of the pumps, project. In this tank, the regulating mechanism for controlling the action of the several groups of pumps is disposed; its character and manner of operating being hereinafter described.

By this arrangement of tank and parts, dust and dirt which find their way into the pumping system, and appears in the tank, can be readily dealt with and removed; and the whole system is very readily kept clean, and thereby wear and tear of the parts by the presence of dirt is, to a large extent, avoided. And it can be movably supported, so as to be easily and quickly lowered or raised.

When there are twelve pumps, these are, as stated, in groups of four, two pumps—one on each side of the shaft—working from one eccentric pulley; and the pumps are arranged to be cut out of action automatically, as their use is not required, four at a time, so as to keep the pump shaft perfectly balanced at all loads.

With regard to the gear for cutting out the groups of pumps, this gear is so contrived and adapted to operate that it automatically adjusts the work of the pumps to the work done by the engine.

In the cut-out gear there are two shafts, one to each set of pumps on each side of this shaft, and parallel to it, and worked together in opposite directions from the pump shaft; and on these shafts, cams of stepped construction are provided; and when the pumps are working, they—the cams—support upon them the heavy ends of rocking levers, one of which is used in connection with an inlet or suction valve of a pump cylinder. The cam shafts rotate, and as the cams on each of them—which are set in the required relative positions—revolve with it, the rocking levers fall in the desired order of succession; and in so doing, the lever presses at its other or light end upon a plunger rod in the suction pipe (which is not mechanically connected up with the lever or valve); and when the pump plunger makes the next suction or outstroke, and the inlet valve lifts, the heavy end of the lever falls and lifts up the plunger rod, and the valve will then be held open by it, and so cuts out the pump.

Each cam is so formed that the weighted lever, when it falls, is clear of the cam body, so as to allow of ample room for movement of the lever after the parts become worn, and valves ground, *etc.*, which will increase the angular travel of the rocking shaft.

The working, that is, rotation, of the cam shafts, is effected automatically through the action of a governor—say a rotary governor—driven from the pump, and having a hit and miss mechanism connected with it. Namely, the governor causes a ratchet wheel or the like to be engaged by a pawl or the like, and to be rotated thereby, so that the cam shafts—which are geared to the shaft on which the ratchet wheel is mounted—are rotated. The actual power for rotating the shafts is obtained from a cam or the like driven from the pump shaft, and which is rendered operative on the ratchet turning device by the hit and miss mechanism controlled or actuated by the governor, and which makes and breaks connection between the parts. In connection with the cam shafts, there is provided a hand actuating or setting mechanism, and an indicator mechanism, similar to an engine telegraph mechanism; the indicator mechanism being arranged to show the number of plungers or pumps which are at work at any moment.

The cam driven by the pump shaft is revolved at a lower speed than the gas

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engine cam shaft, so as to ensure the engine getting in at least one operative stroke before the pump governor can operate twice.

The ratchet or like wheel has one tooth less than the number of powers of the pumps, so that the pumps used for supplying pressure water to the ram or rams—generally called the "finishing ram"—which are last operated in the cycle of press operations, cannot be cut off.

The governor is adapted to turn the cam shafts in one direction only, and the gear is irreversible; and when the groups or sets of pumps required to be cut out, have been cut out, they are at the desired time all put in the active condition again by the man in charge of the hand actuated "telegraph" mechanism referred to, by revolving the instrument so as to complete the revolution of the shafts through 360°.

The pump governor is adjusted to act at about 5% under normal speed of the engine. On starting, the operator or valve-man revolves the setting mechanism to a position which is called, say, 12 by the indicator, when all the plungers are switched or put in the active condition, and pumping proceeds until the pressure attained is such that the engine does not miss any explosions, and slows down, say 5%; and in so doing, it will have transferred energy to its heavy fly wheel. Four—or it may be two, or any required number—plungers are by this slowing down, through the action of the governor, as above described, cut out. The load being thus reduced, the speed of the engine will increase, thereby again transferring energy to the fly wheel, which is again given out before the speed is reduced enough to cause the governor to act again.

Assuming at the finishing of the bale, that all the pumps connected with the first operations of the baling press—which are the low pressure pumps—are cut out, then a bye-pass valve is opened, and in this condition, when the pumps are again thrown in, the flow through it will be very small, as they—the pumps—are not thrown in with a jerk.

In the case of an accumulator being used, it will be started slowly; and if more accumulator water is required, the valve man can throw in as many pumps as he wants; and when the accumulator is at the top of its stroke, by putting his telegraph or setting lever at the zero position, all the pumps are thrown out.

The pump cylinders or barrels will, in the preferred arrangement, have the inlet and outlet valves at different points in their length; namely, the inlet valve will be at the outer end, and the valve seat is fastened in from below—say screwed in, a leather or other suitable jointing washer being provided between its flange, and a seat or shoulder in the underside of the cylinder. The valve itself has a stem above, which works in a guide screwed into the top of the cylinder from above; and having a leather or other jointing washer or ring between its outer flange and the recess in the cylinder. Thus both joints are outside, and leakages can be seen.

The delivery valve is placed on the cylinder away from the inlet valve, and is of the same kind as that just described, and the seat for the valve consists of a ring with an annular flange between its ends; and the lower annular face of this flange rests on a leather or like jointing ring in a recess in the top of the pump barrel; whilst the upper shoulder or face rests or lies in contact with a similar leather or like washer ring fitting in a recess in the bottom of the valve case, which is separate, and the underside of which stands above the pumps; and the whole casing and seat may be fastened and pressed down onto the cylinder by bolts or the like.

All the packed joints, therefore, are outside, and leakages which may take place in any of them can be at once detected, and thus wastage of pressure water, which is important, can be stopped; whereas internal leakages cannot be seen or detected, and may be very extensive without their existence being known.

The packing at the gland end of the pump cylinder consists of a cup leather,

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and a separate metallic ring, in which the outer part or crown of the cup leather rests; and the metal ring is held in position by a screwed in gland.

Dated this 19th day of October, 1909.

E. R. ROYSTON & Co.,
Applicants' Patent Agents,
Tower Building, Water Street, Liverpool, and
265, Strand, London, W.C.

COMPLETE SPECIFICATION.

Improvements in and connected with Pressure Pumping Machinery.

We, FREDERICK WILLIAM POATE, of 15, Sansouci Terrace, Shanghai, China, Engineer, and FAWCETT PRESTON AND COMPANY, LIMITED, of 17, York Street, Liverpool, in the County of Lancaster, England, Engineers, do hereby declare the nature of this invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has reference to pumping machinery, and more particularly to that kind of such machinery which is used for pumping water to hydraulic presses of various kinds, such as cotton, hemp, and similar loose goods presses; bale goods presses; and analogous or equivalent presses. And it has for its chief objects and effects to generally improve such pumps or pumping machinery, so that their efficiency is generally raised, and their parts shall be very accessible, leakages shall be visible, and waste of power, and wear and straining of parts diminished. While also, at the same time, it has been the object to provide pumping machinery which is simple and not costly.

In the following description of pumping machinery, the improvements hereunder are comprised; and in the accompanying drawings, in connection with which the description is made, these improvements are illustrated.

It will be assumed in the following description that the pumps will be used for supplying water to presses where different quantities of water are to be pumped and supplied to the press at different periods or stages of its operation, or cycle of operation, and that in these periods or stages, the pressure of the water supplied varies; also that the pumps are driven by a belt, driven by a gas or oil engine.

In the drawings,

Figure 1 is a plan of the pump;

Figure 2 is a cross section showing parts of the pump to a larger scale; and

Figures 3 and 4 are elevations illustrating the cut-out mechanism.

Referring now to the drawings, the pump cylinders 1 and plungers 2 are in multiple, and are arranged in groups on each side of the driving or operating shaft 3, as shown in the drawings. For instance, there may be advantageously employed twelve cylinders and plungers, as in the case shown—six on each side; and the plungers are worked by eccentrics 4 which operate crossheads 5 connected with the plungers 2, and working in guides 6.

Two adjacent eccentric straps are mounted on a common eccentric pulley and each strap is connected to and works one plunger, one on one side, and the other on the opposite side of the shaft 3; and these plungers are arranged in groups, preferably four, and the eccentric pulley operating one pair of plungers is set at 90° to the pulley operating the other pair of plungers.

That is to say with regard to the grouping of the eccentrics 4 and pumps 1, the "leader" eccentric pulley of the group will be 90° from the "following" eccentric in each group, as described; and all the "leader" eccentrics are equally

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spaced round the circle; and if there be twelve pumps arranged in three groups, these three "leader" eccentrics will be spaced apart at 120°. By this arrangement, shock in the pipe line is, to a large extent, eliminated, as no two pump valves come to their seats simultaneously, and with the even discharge of water thus provided, there are no dead centres; and in consequence a light fly wheel pulley 7 on the pump driving shaft is sufficient to ensure even cyclic speed. This is especially advantageous in pumps driven by gas or oil engines through belts, as in addition to a heavy fly wheel being costly, hunting sets up between the gas engine and the pumps, causing the belt to flap violently at each operative stroke of the engine.

The eccentrics 4 will dip into a sump or pit 8, provided in the bed 9 of the pump, holding oil; and a cover 10 is provided over them to prevent the splashing of oil made by the eccentrics dipping into it. The edges of the cover or hood are carried from a rib 11 formed on and extending between the guides 6.

The pump cylinders 1 are mounted on the top of the bed 9; and outside this bed, and below the level of the pumps, there is provided an open tank 15, say of thin steel or other suitable material, and into which the depending suction or intake pipe 16—which are short—of the pumps, project. In this tank, the regulating mechanism for controlling the action of the several groups of pumps is disposed, its character and manner of operating being hereinafter described.

By this arrangement of tank 15, and parts, dust and dirt which find their way into the pumping system, and appear in the tank, can readily be dealt with and removed; and the whole system is very readily kept clean, and thereby wear and tear of the parts by the presence of dirt, is, to a large extent, avoided. Moreover, the tank 15 can be supported in such a way that it can be easily and quickly lowered and raised, so as to get it out of the way of the pumps as and when required.

The pumps 1 are arranged to be cut-out of action automatically, as their use is not required, four at a time, so as to keep the pump shaft balanced at all loads; and with regard to the gear for effecting this cutting out in groups, it is so contrived and adapted to operate, that it automatically adjusts the work of the pumps to the work done by the engine.

In the cut-out gear there are two shafts 17, one to each set of pumps on each side of the shaft 3, and parallel to it, and they are worked together in opposite directions from the pump shaft 3 through another shaft 18, worked by the governor as hereinafter described.

On the shafts 17, cams 19 of stepped construction are provided; and when the pumps are working, they—the cams—support upon them the heavy ends 20 of the rocking levers 21, one of which is used in connection with an inlet or suction valve 22 of a pump cylinder 1.

The cam shafts are rotated, and as the cams 19 on each of them—which are set in the required relative positions—revolve with them, the rocking levers 21, when left by the "rise" of the cams 19, fall in the desired order of succession, and in so doing, the lever 21 presses at its other or light end upon a plunger rod 23—not mechanically connected up with the lever or valve—in the suction pipe 16; and when the pump plunger 2 makes the next suction or outstroke, and the inlet valve 22 lifts, the heavy end 20 of the lever 21 falls and lifts up the plunger rod 23, and the valve will then be held open by it, and so cuts out the pump.

Each cam 19 is so formed that the weighted lever 21 when it falls, is clear of the cam body; that is, the "rise" of the cam at the end has a sudden "drop", and of greater length than the fall of the heavy end 20, and so it allows of ample room for the lever after the parts become worn, and valves ground, *etc.*, which will increase the angular travel of the rocking levers.

The working, that is, the rotation of each cam shaft 17 is effected automatically through the action of the governor 25, driven from the pump shaft 3 through

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spur gearing 26, and having a "hit and miss" mechanism connected with it, which, in the case shown, consists of a bowl 27 carried on a spindle 28 fixed in the governor carrier bucket or frame, and adapted to move longitudinally to and fro on the spindle 28 by a bell crank lever 29, which the governor operates. Through this means, the governor causes a ratchet wheel 30, fixed on the shaft 18, to be engaged by a pawl 31 on a lever 32, and to be rotated thereby; so that the cam shafts 17, which are geared to the shaft 18, are rotated. The actual power for rotating the shafts 18 and 17 is obtained from a cam 33 driven from the pump shaft 3 through a spindle 34—on which the cam is mounted—carrying one of the bevel wheels 26. This cam becomes operative on the ratchet turning device by the hit and miss bowl 27 controlled by the governor 25, and which makes and breaks connection between the cam 33 and a roller 35 on a spindle 36 connected with the ratchet lever 32, when such bowl is introduced between this cam 33 and roller 35, and removed from between them, respectively.

In connection with the cam shafts there is provided a hand actuating or setting mechanism, and an indicator mechanism, similar to an engine telegraph mechanism; the indicator mechanism being arranged to show the number of plungers or pumps which are at work at any moment. This indicator of this mechanism may be adapted to be operated by the shafting 18, 17, through sprocket chains and wheels; while the cam shafts would be operated by the press-man through an actuating handle or lever, similarly to a ship's "telegraph".

The cam 33, driven by the pump shaft 3, is revolved at a lower speed than the gas engine cam shaft, the gear wheels 26 being such as to effect this; and this ensures the driving gas or oil engine getting in at least one operative stroke before the pump governor 25 can operate twice.

The ratchet or like wheel 30 has one tooth less than the number of powers of the pumps, so that the pumps used for supplying pressure water to the ram or rams—generally called the "finishing ram"—which are last operated in the cycle of press operations, cannot be cut out.

The governor 25 is adapted to turn the cam shafts 17 in one direction only, and the gear is irreversible; and when the groups or sets of pumps required to be cut out, have been cut out, they are at the desired time all put in the active condition again by the man in charge of the hand actuated "telegraph" mechanism referred to. That is to say, the man, by revolving this "telegraph" instrument mechanically, can turn the shafts 18, 17, so as to complete the revolution of these shafts through 360°.

The pump governor is adjusted to act at about 5 *per cent* under normal speed of the gas or oil engine; and on starting, the operator or valve-man revolves the setting mechanism by the "telegraph" to a position, which, say, is called "12" by the indicator, when all the plungers will be switched or put in the active condition, in which condition the "rises" of the cams 19 will be away from the heavy ends of the lever 21. Pumping then proceeds until the pressure in the water delivered from the pumps is such that the driving engine does not miss any explosions, and slows down, say 5 *per cent*; and in so doing, it will have transferred energy to its heavy fly wheel.

Four plungers—or it may be two, or any required number of plungers—are by this slowing down, through the action of the governor 25, as above described, cut out. The load being thus reduced, the speed of the gas or oil engine will increase, thereby again transferring energy to the engine fly wheel, which is again given out before the speed is reduced enough to cause the governor to act again.

Assuming the finishing compression of the bale within the press, that all the pumps connected with the first operation of the baling press—which are the low pressure pumps—are cut out; then a bye-pass valve is opened; and in this

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condition, when the pumps are again thrown in, the flow through it will be very small, as they—the pumps—are not thrown in with a jerk.

In the case of an accumulator being used, it will be started slowly, and if more accumulator water is required, the valve-man can throw in as many pumps as he wants by means of the "telegraph" mechanism; and when the accumulator is at the top of its stroke, by putting his "telegraph" or setting lever at the zero position, all the pumps are thrown out.

The pump cylinders or barrels 1 will, in the preferred arrangement, have the inlet valve 22 at their outer ends, and the discharge valve 40 on the top.

The valve seat 41 of the valve 22 is fastened in from below, say screwed in, with a leather or other suitable jointing washer provided between its flange and a seat or shoulder in the underside of the cylinder; and the valve 22 itself has a stem above, which works in a guide 42 screwed into the top of the cylinder from above; which has also a leather or other jointing washer or ring between its outer flange and the recess in the cylinder in which it fits. Thus both joints are outside, and leakages can be seen.

The delivery valve 40 is of the same kind as the valve 22; and the seat 43 for the valve consists of a ring with an annular flange, as shown, between its ends; and the lower annular face of this flange rests on a leather or like jointing ring in a recess in the top of the pump barrel, as shown; while the upper shoulder or face rests or lies in contact with a similar or like washer ring fitting in a recess in the bottom of the valve case 44, which is separate, and the underside of which stands above the pump barrel 1; and the whole casing 44 and seat 43 may be fastened and pressed down onto the cylinder 1 by bolts or the like.

Thus, in this case also, all the packed joints, as it were, are "outside", and all leakages which may take place in any of them, can be at once detected, and thus wastage of pressure water, which is important, can be stopped; whereas internal leakages cannot be seen or detected, and may be very extensive without their existence being known.

The packing at the gland end of the pump cylinder consists of a cup leather 45, and a separate metallic ring 46, in which the upper part or crown of the cup leather rests, and which is pressed and held in position by the screwed gland 47.

It is to be stated that it has been proposed heretofore in connection with hydraulic pumping machinery of the multiple cylinder type to cut out some of the pumps when the pressure in the pump delivery attains a certain value, such cut-out means comprising unbalanced levers disposed beneath rods which hold the suction valves open as soon as the levers are released by the action of a spring controlled plunger, subject to the delivery pressure.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In or connected with gas or oil engine driven liquid pumps, having multiple cylinders and arranged in groups, a cut-out mechanism for throwing said groups into and out of operation, operated by a governor, so arranged as to effect the cutting out of the pumps as the pumps slow down, due to a rise of pressure in the hydraulic system; substantially as described.

2. In liquid pumps of the kind herein referred to having multiple cylinders, and arranged in groups, a cut-out mechanism comprising cams adapted to operate upon levers or the like, arranged to operate upon the inlet valves of the pumps, and operated through a governor driven by the pump, and operating a hit and miss arrangement, by which motion from the pump is transferred to the cams when the said hit and miss arrangement is moved into the active position between a part moved by the pump and the cam shaft; substantially as described.

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3. In liquid pumps of the kind herein referred to, having multiple cylinders, and arranged in groups, a cut-out mechanism of the kind herein referred to operated from the governor, and arranged so as to be operated in one direction only through a ratchet mechanism, or its equivalent; substantially as described.

4. In a gas or oil engine driven liquid pump having multiple cylinders, and arranged in groups, a governor on and operated from the pump, and controlling the action of the cut-out gear operated from and by the pump, and arranged and adapted to act at slightly under the normal speed at which the pump driving gas or oil engine is adapted to operate, whereby when the pressure attained is such that the engine ceases to miss explosions (and will have transferred energy to its heavy fly wheel), and slows down, the groups of pump plungers are, by such slowing down, and the action of the governor, cut-out, so that the load thus being reduced, the speed of the engine will increase again, and the operations are repeated; substantially as described.

5. In liquid pumps of the kind herein referred to, having multiple cylinders, and arranged in groups, the construction of the pump cylinders with their inlet and outlet valves, seatings, and parts all arranged as described, with the packed joints outside, so that any leakage of pressure water at any joint can be at once detected; substantially as described.

6. In liquid pumps of the kind herein referred to, having multiple cylinders, and arranged in groups, the arrangement of the cut-out cams for effecting the operation of the levers in connection with the inlet valves; substantially as herein described with reference to the accompanying drawings.

7. In a liquid pump of the kind herein referred to, having multiple cylinders, and arranged in groups, a tank or tanks, as 15, disposed outside the bed 9 of the engine, and below the outer end of the pump cylinders in which the intake pipes of the pumps, and the cut-out mechanism for same are disposed; substantially as set forth.

8. Pumping machinery operated by gas or oil engines through belt or like driving gear, arranged and adapted to operate substantially as herein set forth and shown.

Dated this 18th day of April, 1910.

E. R. ROYSTON & Co.,
Applicants' Patent Agents,
Tower Building, Water Street, Liverpool, and
265, Strand, London.

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Fig. 1.

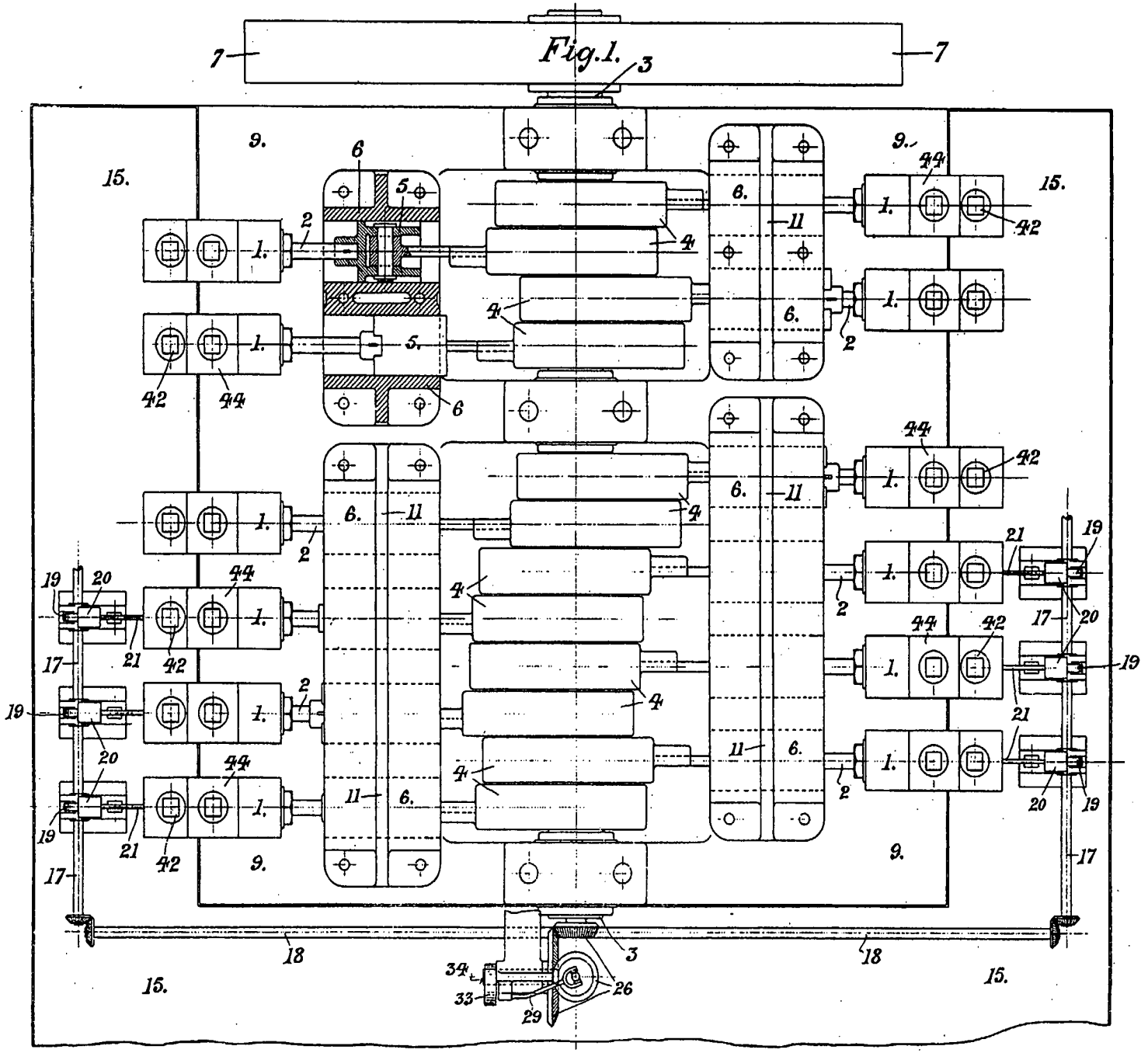

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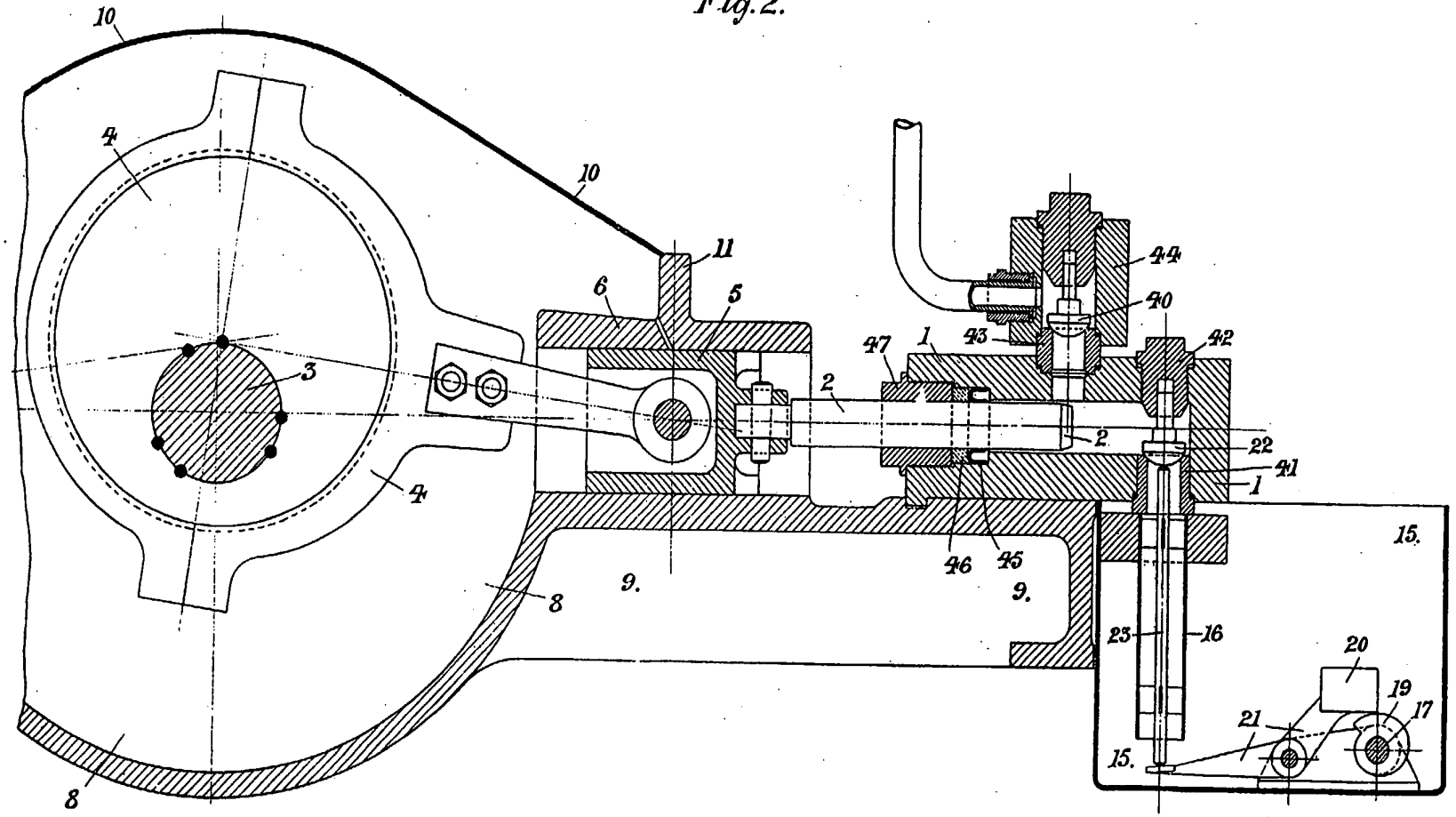
Fig. 2.



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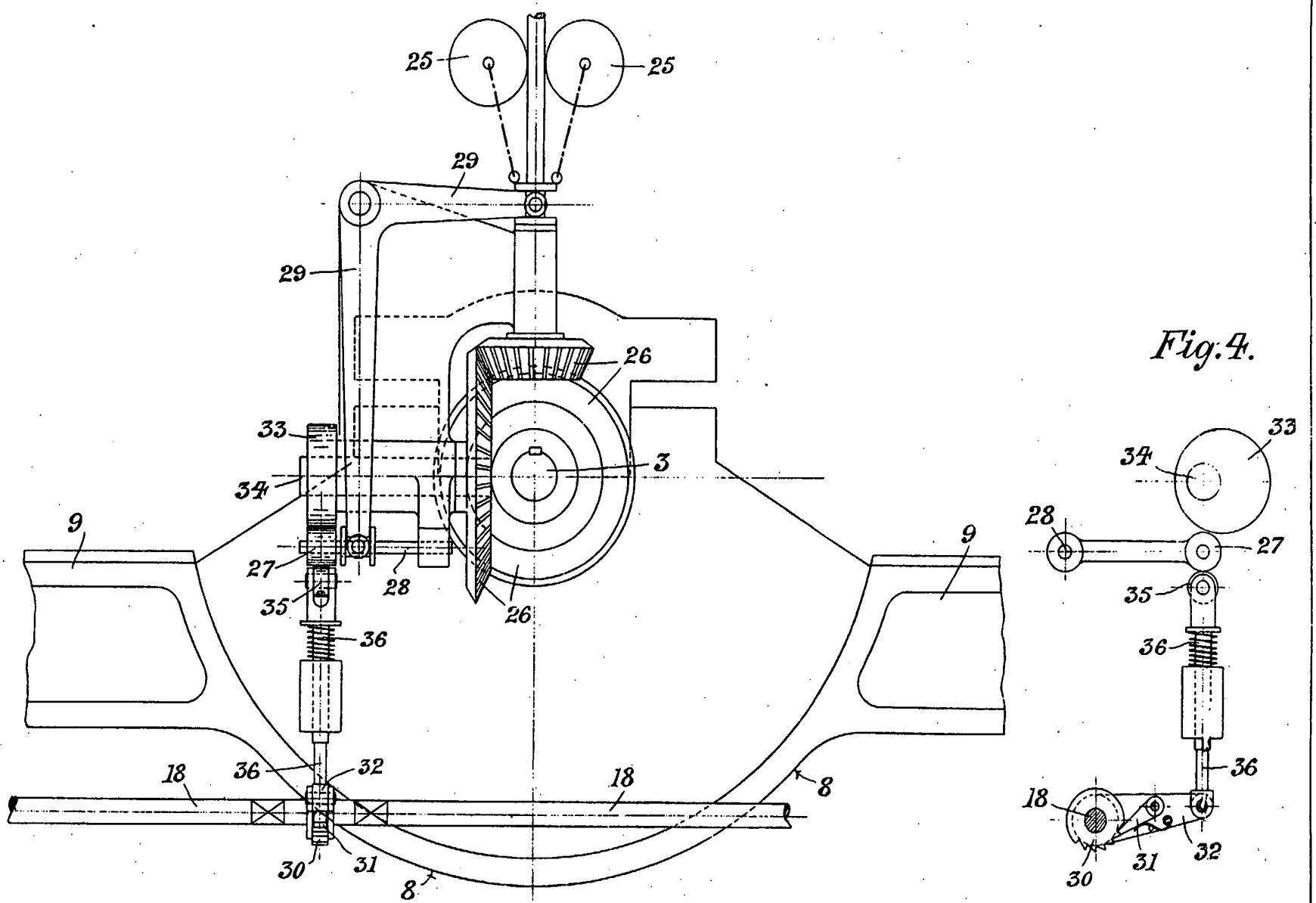

Fig. 4.

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